

Updated May 23, 2001

INTRODUCTION

The current environment of dual use Low Observable/Counter Low Observable (LO/CLO) technologies has made it extremely difficult to distinguish between technologies which are appropriate for export through the commercial marketplace and militarily critical technologies requiring further controls. This section is intended to highlight for users of signature control technologies the export coordination and approval requirements and critical LO and CLO technologies. The MCTL must be used in conjunction with other relevant program and policy guidance, to include the following:

- DoD 5220.22M, "National Industrial Security Program Operating Manual (NISPOM)
- DoD Instruction S-5230.28, "Low Observable (LO) and Counter Low Observable (CLO) Programs (S-NF)," October 2, 2000
- "Security Classification Guide for Department of Defense (DoD) Low/Counter Low Observable (LO/CLO) Programs (U)," October 2, 2000
- Specific program classification guidance
- Government contractual guidance

PROCEDURES

The common theme found throughout DoD guidance is the need for early coordination of requirements with the expectation that industry will make contact with the Service LO/CLO Offices of Primary Responsibility (OPRs) if licensing arrangements are required. The MCTL and DoD policies/instructions provide threshold values for various signature control technologies and applications. When these thresholds are exceeded, a DoD technical review of the signature control aspects of the proposed export is required prior to it being licensed for export. These threshold/tripwire values apply to a wide range of systems and their technologies. Some of these, such as helicopters, UAVs, assault ships, missiles, etc. will usually fall below the stated values. The mandated review process discussed below will accommodate these variations and in fact assure consistency and accuracy in case processing. Early

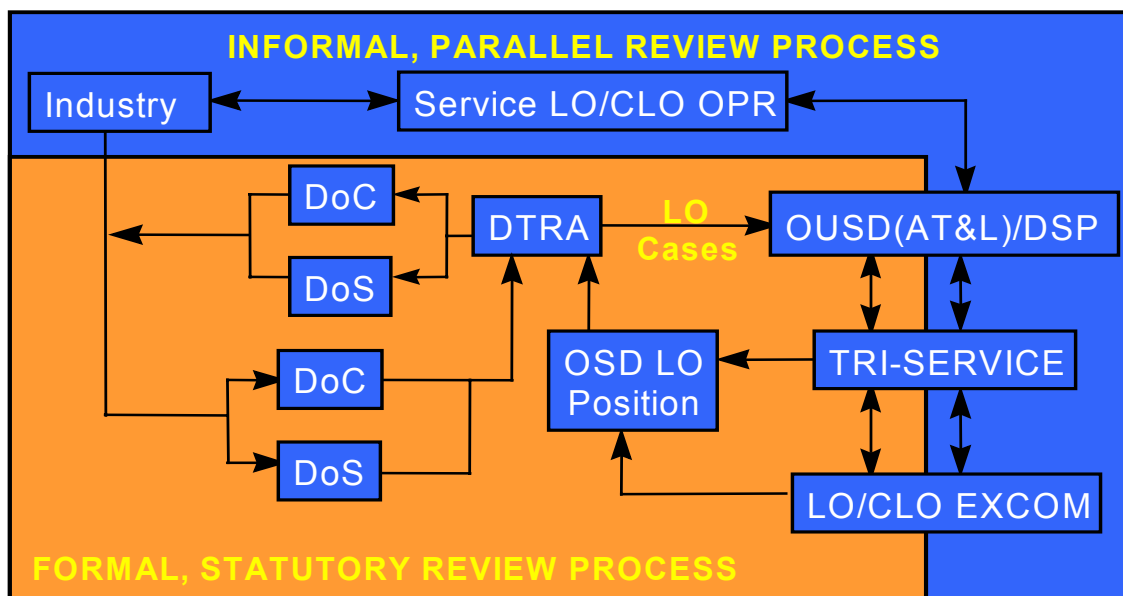


Chart 1: Process for Review of Signature Control Technologies

coordination with the appropriate Service LO/CLO OPRs will facilitate more timely determination of DoD concerns or limitations for the proposed export. As shown in Chart 1, the normal statutory review process for conducting export license approvals is supplemented by an LO/CLO review process, defined by DoD Policy.

Within the Department of Defense, each Service has a central office to provide basic guidance regarding LO/CLO classification and policy. The following offices are designated by DepSecDef as the Service LO/CLO Office of Primary Responsibility (OPRs):

AF:	SAF/AQL Directorate of Special Programs Assistant Secretary (Acquisition) Pentagon Washington, DC 20330-1060	(703)588-2083
Navy/Marines:	Director, LO/CLO Policy and Technology (N91) Crystal Square 2, Room 213 1725 Jefferson Davis Highway Arlington, VA 22215	(703) 413-2263
Army:	Director of Special Programs (SAAL-SO) Room ID711 Pentagon Washington DC 20310-0103	(703) 614-0152

Under the direction of the DepSecDef, USD(AT&L) manages and chairs the LO/CLO Executive Committee (EXCOM). The LO/CLO EXCOM oversees technology development and progress of key LO/CLO programs to focus and direct efforts as necessary and resolve issues that arise as programs mature. The EXCOM also sets overall technical policy on international transfer of LO/CLO information and capabilities and coordinates exceptions to National Disclosure Policy when necessary. The EXCOM also establishes security guidelines to insure consistent application of security policy to protect critical LO/CLO technologies.

USD(AT&L) has appointed the Director of Special Programs, who reports directly to USD(AT&L), as the DoD Director of LO Technology. The Director functions as the principal coordinator of all LO and CLO issues and is the executive secretary for the LO/CLO EXCOM. The Director ensures proper management oversight is applied to all LO/CLO special access programs (SAPs) and activities. The Director reviews and makes recommendations about the international transfer of LO/CLO information and capabilities consistent with EXCOM guidance and National Military Information Disclosure Policy Committee Policy Statements. The Director of Special Programs also chairs the Tri-Service Committee. This group meets frequently to coordinate DoD Component and LO/CLO activities. The committee makes recommendations concerning LO/CLO programs, policies, plans, studies, and exports consistent with this policy and previous EXCOM decisions.

To facilitate the timely DoD review of LO/CLO export cases, the following information (where appropriate to the specific export license request) is required:

- The specific “foreign requirement” for this technology (e.g., Request for Technology (RFT), Request for Information (RFI), Statement of Work (SOW))
- U.S. initiative supporting the requirement (e.g., business plan, briefing material)
- Applicable current guidance (e.g., security guide, MCTL, National Disclosure Policy (NDP), specific contract)
- Legacy of the LO/CLO technology (e.g., foreign release history – related export cases)
- Technology specification (e.g., material composition, performance, weight, cost) - this must be done for the specific item being requested for export, including comparable items available from other U.S. companies and from foreign sources

- Identify critical technologies in the export request and assess performance vs. LO/CLO policy and guidelines
- Proposed program review (platform, subsystem, component, materials, technologies)
- Program Protection Plan (including anti-tamper plans)

This section provides an outline of the signature control technologies license review and approval process. Critical LO/CLO technologies are considered sensitive to the Department of Defense. Current DoD Policy states that they will not be exported without review by the LO/CLO EXCOM process. The timeliness of this review process can be facilitated by using the informal, parallel process shown in the Chart 1.

CRITICAL LO TECHNOLOGIES

The following technologies, though not all inclusive, are critical to achieving LO capability at a system level. The Service component LO/CLO OPR will assess component performance requirements against thresholds defined by DoDI S-5230.28 to support proper level of classification.

Materials and Structures

General

- Aircraft, missile or ship LO compatible rain erosion coatings.
- Any radar absorbing material (RAM) designed for or usable in extreme environmental conditions.
- Composites combined or formed into integral radar absorbing structures.
- LO antennas, radomes and windows.

RCS - Dielectric

- Ceramic RAM and radar absorbing structure (RAS). High temperature ceramic RAM (>300°F).
- Materials which use polymers loaded with carbon fibers, dielectric RAM, graded dielectric (e.g., dipped ink) honeycomb, radar absorbing metals on cloth, Jaumann and other such designs, ceramic, reticulated foam, diamond coatings, thin films, and millimeter wave aerosols.
- RAM/RAS including, but not limited to honeycomb cores/foams, and whiskers, fibers and flakes.

RCS - Magnetic

- High temperature magnetic RAM (>300°F).
- Materials that use polymers loaded with carbonyl iron powder (CIP), ferrites, iron whiskers, fibers and flakes or other magnetic additives.
- RAM and RAS including, by not limited to, magnetic particles, whiskers, fibers and flakes, magnetic films, or other resistive/magnetic materials.
- Broadband (>30% bandwidth), lightweight (<2 lbs/sq ft) magnetic RAM.
- Raw, passivated (anti-rust treated) carbonyl-iron or similar microspheres.

Signature Control

Acoustic - Treatments that reduce the acoustic signature by using active noise cancellation, modulation of jet or diesel engines, tracks, rotor blades or other noise sources or advanced passive acoustic absorptive techniques.

Infrared

- IR signature reduction materials and techniques including, but not limited to, paints, controllable emissivity and/or reflectivity characteristics, E-O characteristics.
- IR transparent binder.
- Electrochromics and thermochromics, diamond coatings.

Laser - Laser signature magnetic techniques.

LO Material Manufacturing Processes - Processes which use microencapsulation or microspheres, which reduce thermal, radar, or visual detection.

Multispectral

- Multi-layer camouflage systems using different technologies to reduce vehicle detectability, which do not impair mobility or agility of the platform.

- Multispectral surface treatments/appliques applied to weapon system platforms to improve IR/visual and/or radar reflectivity characteristics.
- Reduction of weapon platform signature or component system due to either active or passive techniques that result in shaping, cooling, or degrading the detection in any spectrum.

Optical

- Visual, including color and dynamic variations.
- Active lighting devices.

Software

- Computer codes which use classified measured data to analyze, predict, design or optimize signature reduction solutions.
- RCS/IR measurement equipment and prediction software.

Test, Measurement, Production and Inspection

- Manufacturing process and equipment specific to producing LO components.
- Manufacturing techniques, processes, equipment and codes that use classified data to analyze, predict, design or optimize signature reduction solutions.
- Computer codes or routines enabling a potential target or device to be analyzed from an observables standpoint.
- Aspects of support equipment such as configuration, design details, operating principles, performance, and quantities disclosing classified characteristics of equipment it tests or supports.
- Items for field portable repair validation of signature reduction integrity.
- Measurement and validation test cells having integrity/accuracy.

Weapon Systems Integration

- Air-to-Air missile systems to include the AMRAAM, AIM-9, and future air-to-air missiles.
- Air-to-ground ordinance to include the joint standoff weapon and advanced air-to-ground ordinance.
- Electronic warfare systems to include jammers, decoys, advanced IR countermeasures, seductive jamming and spoofing, synthetic aperture radar countermeasures, high power microwave, high power frequency.
- LO-treated Weapons systems for ground, sea or air.
- Surface-to-air missile systems to include Medium Extended Air Defense Systems (MEADS).
- LO Integrated System in which functionality is enhanced or enabled by combinations of the above using tradeoffs and applications to create reduced system signature. This Integration may occur from conception, through system design, production to the completion of life cycle operation.

CRITICAL CLO TECHNOLOGIES

The following technologies are critical to achieving robust CLO capability at a system level. The Service LO/CLO OPR will assess performance capabilities against thresholds defined by DoDI S-5230.28 to support proper level of classification.

Elemental Devices: Devices for which the application is general in nature.

- Power transistors
- Digital signal processing (DSP) chips
- Ferrite components: oscillators
- Monolithic Microwave Integrated Circuits (MMICs)
- Low Noise Amplifiers (LNAs)
- A/D & D/A converters
- Millimeter wave sources (solid state & tube)
- Doppler filters
- Circulators

Complex Devices/Methods: Devices/methods whose application is more specific in nature.

RF Devices:

- Exciters
- Receivers
- Electronically steered antennas
- Waveform generators
- Transmit/Receive modules
- Frequency synthesizers

IR Devices:

- Focal plane arrays
- IR domes/windows

RF Processing Techniques

- Complex radar waveforms and processing
- Space-time adaptive processing
- Adaptive digital beamforming and nulling
- ESM for LPI waveforms
- Adaptive waveforms
- ISAR/SAR
- Super resolution

IR Processing Techniques

- Non uniformity compensation
- Clutter discrimination algorithms
- Multi-frame image processing

General Techniques

- Sensor fusion
- Non-cooperative target recognition
- Interference suppression
- High Power Microwave

Miscellaneous

- Application specific integrated circuits (ASICs)
- Methods designed to exploit unique LO signature characteristics

CLO Subsystems: Complex collections of devices for which performance objectives include the ability to perform a CLO function. Performance is typically determined relative to some LO signature characteristic, such as RCS. Examples of CLO subsystems are:

- RF sensors
- IR sensors
- Fuzes

CLO Systems: Collections of devices and subsystems that perform a specific CLO warfighting function. Performance is typically determined relative to some LO signature characteristic, such as RCS. Examples of CLO systems are:

- Surveillance radar systems (e.g. SPY-1, JSTARS)
- Sensor fusion systems (e.g., Cooperative Engagement Capability)
- Fire control radars (e.g., Multi-Function Radar)
- Missiles , Directed Energy (e.g., AMRAAM, AIM-9X, ESSM, STANDARD)

CLO Systems of Systems: Groups of systems tied together functionally to create an entire CLO kill chain capability (initial detection through target kill). Examples of CLO systems of systems are:

- Ship self defense system (e.g., NATO Seasparrow)
- Air defense weapon system (e.g. Patriot)
- Integrated air defense system